High-Bandwidth Photon-Counting Detectors with Enhanced Near-Infrared Response, Phase II

Completed Technology Project (2010 - 2013)

Project Introduction

Long-range optical telecommunications (LROT) impose challenging requirements on detector array sensitivity at 1064nm and arrays timing bandwidth. Large photonic arrays with integrated beam acquisition, tracking and/or communication capabilities, and smart pixel architecture should allow the implementation of more reliable and robust LROT systems. Integration of smart pixel technology for parallel data acquisition and processing is currently available in silicon. Current silicon photon-counting detector arrays benefit from a worldwide manufacturing and R&D infrastructure but their response at 1064nm is not suitable for LROT. In Phase I we proposed to verify the feasibility of increasing the responsivity of aPeak's silicon photon counting arrays at 1064nm by increasing their quantum absorption efficiency and demonstrating sub-nanosecond timing resolution. Phase I resulted in photon counting arrays with enhanced response at 1064 nm. Modules to be implemented into the readout IC (ROIC) have been fabricated in compact ASIC designs, suitable for integration into the smart pixel fabric ⬭ they have demonstrated 100ps timing jitter and have exceeded the dynamic range requirements. Noise, timing resolution, and linearity requirements meet updated program requirements Phase II program builds upon Phase I results and previous smart pixel development at aPeak Inc with the aim to develop photon-counting arrays with enhanced 1064nm response and integrated counters at pixel level, capable of high - timing resolution and high counting rate. We propose to develop the photon counting detector arrays, associated ROIC arrays in ASIC, technology to assemble the detector and ROIC arrays, as well as in process ASIC mapping and maskless correction methods critical for the detector fabrication. Detector array design will be improved to meet the detection efficiency at 1064nm, while preserving or improving the detector noise, timing resolution, and linearity demonstrated in Phase I

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Table of Contents

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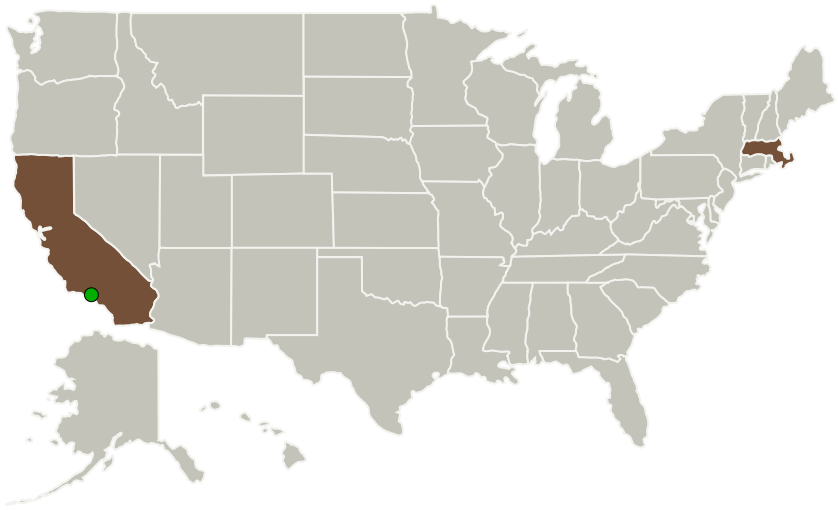
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
aPeak, Inc.	Lead Organization	Industry	Newton, Massachusetts
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

March 2010: Project Start

March 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139076)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

aPeak, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

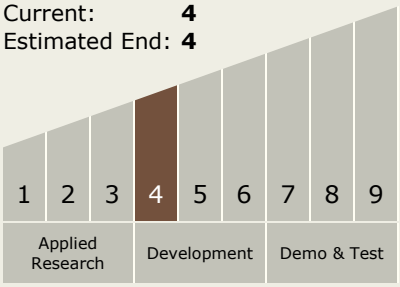
Carlos Torrez

Principal Investigator:

Stefan A Vasile

Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **4**



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Completed Technology Project (2010 - 2013)

Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.1 Optical Communications
    - TX05.1.1 Detector Development

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System